Avian Influenza: Implications for Agriculture and Public Health

Satellite Conference
Friday, August 5, 2005
12:00 - 1:30 p.m. (Central Time)

Produced by the Alabama Department of Public Health
Video Communications Division

Faculty

Frederick J. Hoerr, DVN, PhD
Director, Alabama Veterinary Diagnostic Laboratory
Auburn University
Auburn, Alabama

Program Objectives:

- Understand Avian Influenza virus serotype and pathotype nomenclature.
- Understand the disease in poultry.
- Understand the consequences of Avian Influenza as an agricultural problem and the potential local and statewide economic impact in a poultry-producing state like Alabama
- Understand Avian Influenza as a public health issue.

Avian Influenza

- Orthomyxovirus (type A)
  - 15 (16) Hemagglutinin and 9 Neuraminidase antigens used to classify virus subtypes
  - Hemagglutinates chicken red blood cells
  - H5 and H7 subtypes common in highly pathogenic AI; others are milder
- Waterfowl are natural reservoir of virus
  - Mostly asymptomatic, excrete virus in feces

Influenza Hemagglutinins (15 Total)

	H1	H2	H3	H4-15
Human	+		+	
Swine	+		+	
Equine	+			
Avian	+	+	+	+ (H5, H7)

Influenza Typing: H and N

- **Hemagglutination:** H
- **Neuraminidase:** N
- Examples
  - H7N2, H5N1, H9N3
  - 9 x15 = 135 combinations
- Humans - usually
  - H1N1, N1N2, H3N2

Avian Influenza Typing: Virulence

- Low Path (LP)
  - Requires trypsin to replicate
  - Stays in the gut, respiratory tract
- High Path (HP)
  - Replicates in the absence of trypsin: systemic disease
  - Chicken inoculation: mortality or hemorrhages
  - Increasing basic amino acids on the Hemagglutination gene lead to trypsin independence
  - Virulence predictable by DNA sequencing of hemagglutination gene

Avian Influenza Outbreaks

- H and N designations remain stable
- Virulence can spontaneously change
  - Low Path can mutate to High Path
  - H5 and H7 highest risk
- "Living with" or accepting AI as an endemic disease can be a time bomb

Avian Influenza (AI)

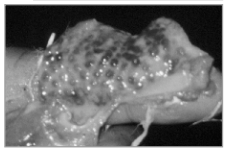
- Virus easily spread on shoes, clothing, crates, equipment, vehicles
  - AI readily spreads from bird-to-bird, and farm-to-farm
  - Live bird markets are reservoirs and high risk

AI Clinical Signs

- Vary greatly depending on age, species, virulence of virus, other infections, and management
- Low Path: Depression, respiratory
  - "Sleepy" chicks

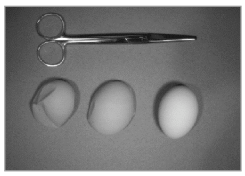
Low Path AI

- Respiratory exudates
- Dehydration
- Hyperemia



Low Path AI

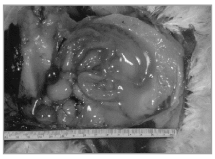
- Respiratory
- Diarrhea
- Egg production
- Mild mortality
- Air sacculitis
- Ovary involution, hemorrhage

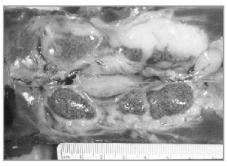


Dr. David Swayne

Low Path AI

- Yolk Peritonitis
- Swollen Kidneys





Dr. David Swayne

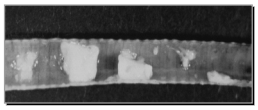
High Path AI

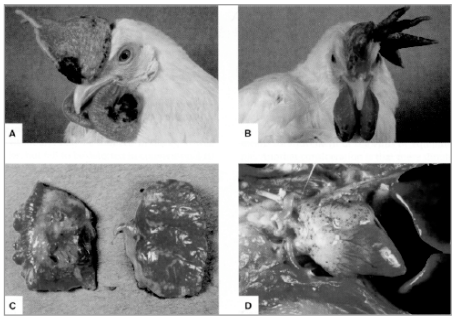
- Sudden onset high mortality
- Depression
- +/- Nervous signs

Dr. David Swayne

High Path AI

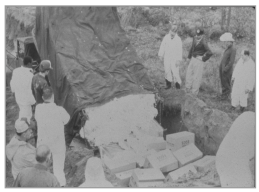
- Affects vasculature
  - Edema, infarction, hemorrhage, and necrosis in many tissues
  - Especially apparent in skin and viscera
- Respiratory exudates
- Reproductive tract regression





Swayne and Halverson, Dis Poultry 11, 2003

Pennsylvania HPAI 1983-84



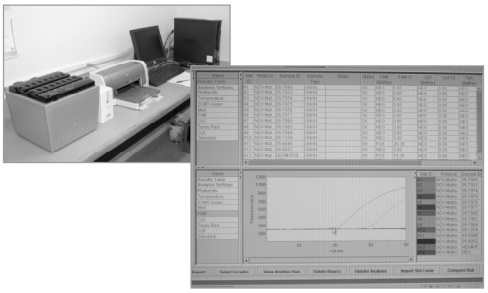
Pennsylvania HPAI 83-84

Penn HPAI

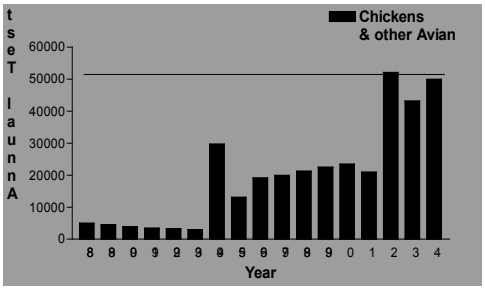
Avian Influenza Diagnosis

- Virus isolation
  - Respiratory tract, cloacal swabs; hemagglutinating virus
  - Virus pathotyping by National Veterinary Services Laboratory
- Antigen capture ELISA
- Serology
  - AGID
  - Hemagglutination Inhibition test (HI)

AI Diagnosis: Real Time PCR



AI Serological Surveillance: Alabama



Real Time PCR: Jan-April 2005

Classification	No. Groups Tested	No. Positive
Backyard	25	0
Breeder	5	0
Game	33	0
Other	21	0
Show	6	0

Avian Influenza Control

- Reportable disease
- Prevention of infection; monitoring by serology (agar gel precipitin test), rrt-PCR
- Vaccines tightly controlled
  - Hinder eradication efforts through seroconversion
  - Genetically engineered viruses in development

Avian Influenza: Control

- Highly pathogenic influenza has been controlled by quarantine and eradication of infected flocks
- Expensive, requires government interaction
- New vaccines may influence this in the future

AI Current Activities In Alabama

- Export serology testing
  - Broilers
  - Game chickens
- Testing all live poultry brought to diagnostic labs (serology)
  - Chickens, backyard, quail, others
- Surveillance by virus isolation, rrt-PCR

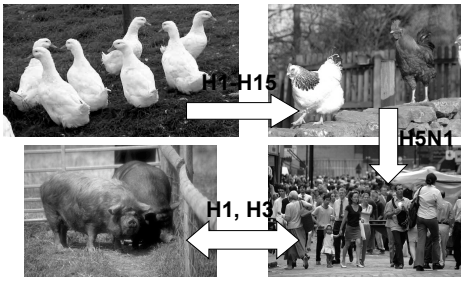
Recent Avian Influenza North America

- H7N2 Connecticut
- H7N2 Delaware
- H5N2 and H7N3 Texas
- H6N2 California
- H7N3 British Columbia

AI Developments

- Delaware, Texas, Canada recent problems
- Human infection and sero-conversion more common than previously thought
- Fatal human infections with H5N1 High Path AI
  - SE Asia and Netherlands
- H5N1 High Path AI unusual traits
  - Fatal for cats (flu-resistant species)
  - Spreads among cats in same environment
  - Domestic ducks have unusually high and prolonged virus shed rate

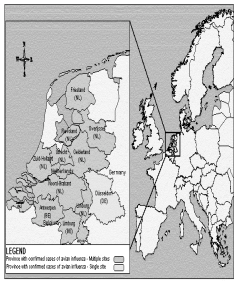
AI Transmission



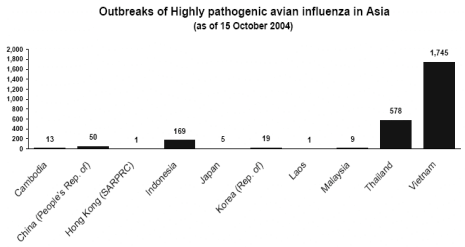
H7N7 Netherlands 2003

Dutch vet dies after bird flu infection

Health authorities in the Netherlands say a veterinarian has died of pneumonia after being infected with the bird flu virus that has been sweeping through the Dutch poultry sector.



Recent Avian Influenza: Poultry



OIE

- **27 September 2004 "The avian influenza epidemic in Asia is a "crisis of global importance"**
- **"Recent outbreaks in China, Vietnam, Cambodia, Malaysia and Thailand show that the virus continues to circulate….and will not probably be eradicated in the near future"**
- **"More research is urgently needed as the role of wildlife, domestic ducks and pigs in transmitting the virus….. is still not fully understood."**
- **"A permanent threat to animal and human health continues to exist."**

WHO: 16 Fatalities In Thailand

- **4 October 2004: Situation in Thailand**
- **"The Ministry of Public Health in Thailand has today confirmed a further case of human infection with H5N1 avian influenza. The case, which was fatal, was a 9-year-old girl….developed symptoms on 23 September, was hospitalized on 27 September, and died of severe respiratory disease on 3 October.**
- **"Investigation of the case has identified exposure to diseased chickens as the most likely cause of infection. Following the death of chickens in the child's household, she assisted in preparation of the birds for cooking, including the plucking of feathers."**

WHO: Estimated Impact of H5 Pandemic

- **2-7 million deaths**
- **Tens of millions sick**
- **Deaths could be dramatically higher**
  - **50 Million**
- **"The pandemic cannot be stopped but preparedness will reduce its impact."**

http://www.who.int/csr/disease/influenza/preparedness2004_12_08/en/index.html

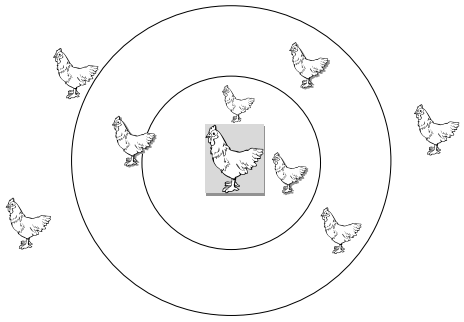
Occupational Concerns

- Agricultural first responders
- Immunization priority
- Personal protective devices
  - Adequate vs. Practical
- Antiviral prophylaxis

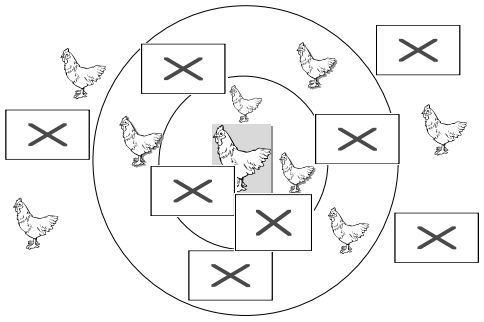
Disease Scenario: Cullman County, Alabama

- Largest producer of poultry and beef in Alabama
- Foreign Animal Disease threats
  - Poultry
    - Exotic Newcastle Disease
    - Highly pathogenic Avian Influenza
  - Cattle
    - Foot and Mouth Disease

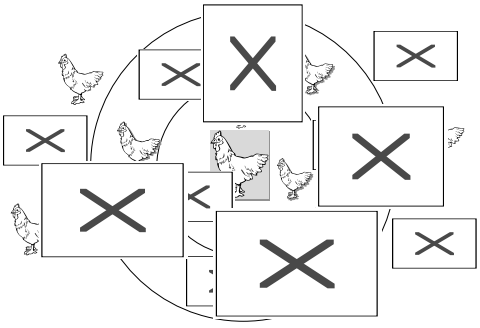
Animal Disease Hot Zone



Animal Disease Hot Zone



Animal Disease Hot Zone



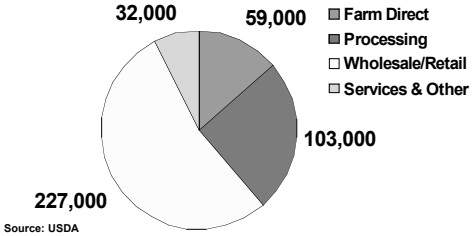
Economic Impact of END/AI in Alabama

- One company complex
  - 1,000,000 chickens @ $2.10 = $2.1 M
  - 850 workers idled; $300,000 payroll/week
  - Disposal of 6,500,000 chickens @ 0.12/lb = $780,000
  - 545 vacant chicken houses, $1,200 per week mortgage = $654,000 unpaid mortgages/wk
  - Farm foreclosures
  - Clean-up costs = $2 M
  - Ramp-up to start production = $2 M

Economic Impact END/AI in Alabama

- For each $1.00 lost directly, $3.91 lost statewide
- If entire state production sidelined
  - $40 M direct losses
  - $50 M indirect per week statewide
  - $10-15 M statewide of unserviced debt
  - 20,000 company employees idled
  - 20-30,000 allied industries employees idled
- Exports stop, surrounding states affected

Alabama Agriculture and Food Sector Employment: 421,000 Jobs



Source: USDA
http://ers.usda.gov/Data/FarmandRelatedEmployment/

Weekly Broiler Placements: Millions of Chickens

ALABAMA	20.8
ARKANSAS	23.8
DE, MD, VA	15.9
GEORGIA	24.2
MISSISSIPPI	13.4
NORTH CAROLINA	13.8
SOUTH CAROLINA	3.7
TEXAS	10.8
CA, TN, & WV , FL, PN	15.5
TOTAL	141.8

Family and Community

- Family stress
- Trauma of losses
- Health risks
- Lost income
- Cash flow
- Loan payments
- Jobs
- Schools
- Financial centers
- Community activities
- Environmental issues
- Influx of Federal and State authorities and workers
- Media focus

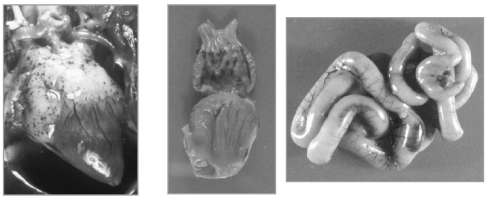
Avian Influenza Summary

- Agricultural economic threat
- State and regional economic threat
- Potential occupational health threat
- Public health threat
- Surveillance and immediate response is key to controlling initial outbreak
- Global situation with H5N1

Swayne and Halverson, Dis Poultry 11, 2003

HPAI: Chickens

- **Pulmonary edema, congestion and hemorrhage**
- **Visceral hemorrhage**



Upcoming Programs

Supporting Children in a Time of Crisis
Tuesday, August 9, 2005
12:00 - 1:30 p.m. (Central Time)

Supersizing of America: The New Challenge of Obesity
Thursday, August 11, 2005
1:00 - 2:30 p.m. (Central Time)

For complete listing of upcoming programs visit: www.adph.org/alphtn